it has often happened, that Pieces of Earth of a Quarter or Half an Acre, have ſeparated themſelves all in one Piece, from the Top of a Hill, and ſlided down viſibly on the Lands lying below.

How conſiderable ſoever this Accident may be in regard to the poor People who ſuffered by it, yet it was to be wiſhed it was the only one that has befallen this Province. The Overflowings of the River *Allier*, and of the Rivers and Brooks that run into it, and the Hail that fell almoſt continually ſince, have intirely ruined above One hundred Pariſhes, in which they will have no Harveſt this Year as for Corn and Hemp, nor any Vintage at all.

V. *A* Diſſertation *on the* Worms *which deſtroy the* Piles *on the Coaſts of* Holland *and* Zealand, *by* Job Baſter, *M. D.* F. R. S. *communicated by the* Preſident *of the* ROYAL SOCIETY. *Tranſlated* * *from the* Latin *by* T. S. *M. D.* F. R. S.

SECTION I.

IN the Year 1730. the Perſons appointed to take care of the Dikes on our Coaſts, obſerved that the Piles made of the hardeſt Oak, defending the Coaſts

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* This is here inſerted in *Engliſh*, becauſe a very ample Treatiſe hath been publiſhed in *Latin* on the ſame Subject, intituled, *Godofredi Sellii*, J. U. D. *R. S. Lond.* S. Hiſt. Nat. *Teredinis* ſeu *Xylophagi* marini. *Tubulo-conchoïdis*, Traj. ad Rhen. 1733. 4to.

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Coaſts of the *Netherlands* againſt the Sea, were eat through in a few Months, ſo as to be broken by the leaſt external Force. Surpriſed at this uncommon and dangerous *Phænomenon*, they inquired into its Cauſe, and ſaw that a ſort of Worms, before that time very ſcarce, but now increaſed to an incredible Number, had in ſo ſhort a time eat into thoſe Piles between the higheſt and loweſt Water-marks, and threatened very great Damage to the Inhabitants of theſe Countries.

The ſuperſtitious Populace immediately perſuaded themſelves, that this new Genus of Animals was created by the divine Wrath for puniſhing the Sins of Mankind: But prying Experience has taught, that thoſe Worms, like other Inſects, were created in the Beginning; but now multiplied to an incredible degree from ſome unknown Cauſe.

SECT. II.

If a Pile of the hardeſt Oak has ſtood ſix Months on the Shore, and be taken out in Summer or Autumn, there appears Mud and Filth ſticking to its outward Surface; which being ſcraped off with a Knife, diſcovers a vaſt Number of Holes, ſcarcely as large as Pins Heads.

SECT. III.

If you view this Mud (SECT. II.) through a Microſcope, you will ſee,

1. A Number of whitiſh Points, not bigger than Grains of Sand.
2. Some very ſmall Worms.

The whitiſh Points ſeem to be the Eggs of this Inſect, and the Worms to be ſuch as are already hatched from them; and theſe Worms gradually perforating the outward Surface of the Wood, rendered ſoft by lying in the Water, made the aforeſaid Holes, (SECT. II.) and through them worked their way into the Subſtance of the Wood.

SECT. IV.

A ſmall Style of Whalebone or Lead, thruſt into theſe ſmall Holes, runs ſtrait into them for three or four Lines, ſo that its outer End always makes a right Angle with the Pile: But afterwards, if the Style be gently puſhed forward, it does not continue in the ſtrait Line, but runs either way, generally upward.

SECT. V.

But if one of theſe Piles (SECT. II.) be ſplit lengthwiſe with a Hatchet or Wedge, it is found full of Paſſages, or hollow cylindrical Ducts, each of which contains a Worm, ſurrounded with a thin teſtaceous Subſtance, exactly filling the Duct, and forming its *Involucrum* or Sheath, in which Sheath it can move with Freedom. *See* SECT. XIX.

Theſe Ducts, (SECT. IV.) beginning at the outward Surface by a narrow Hole, grow gradually wider, and run either ſtrait, oblique, upward or downward. But what is moſt ſurpriſing is, that theſe Ducts never run into one another, nor communicate; but each of them continues ſeparate for every ſingle Worm. Over the Worm's Head there are found two or three Drops of a ſalt Liquor, thicker than Water, but not

not the leaſt Appearance of the Duſt of the corroded Wood.

SECT. VI.

Whence it appears, that all the Wood, which had before filled up the Place of the Duct, in which the Worm with its Covering is now found, was eaten and conſumed by the Worm: And as it ſeems quite incredible, that an Animal, which appears ſoft, and almoſt as fluid as the White of an Egg, ſhould be able to eat through ſuch hard Wood; I offer the Deſcription of this *Xylophagous Worm* to the ROYAL SOCIETY, in order to give them ſome Knowledge of this Water-Inſect, which has done ſo many Millions Damage to theſe Countries.

SECT. VII.

They are found of various Sizes and Thickneſs. There are ſome of the younger ones not above an Inch or two in Length; ſome of a middle Size, ſuch as we have repreſented in our firſt and ſecond Figures; ſee TAB. II. and ſome thirteen or fourteen Inches long.

SECT. VIII.

But in order to a more accurate Deſcription, we will divide the Animal into Head, Body and Tail.

The Head is of a moſt wonderful Structure, being covered with two hard . . . (I know not which to call them, Shells or *Hemicrania*) of a Subſtance neither teſtaceous nor oſſeous, ſecuring their ſofter Contents: And being viewed through a Microſcope, they appear as in Figure 3. as well as I could have them drawn.

SECT. IX.

Theſe *Hemicrania* are two white Bodies, much harder than the Subſtance which forms the teſtaceous Covering; the inner Surface hollow and ſmooth; the outer, convex and rough, with three Fibres running different ways; and both together perfectly repreſent a double Bit, of that kind of Borer, we call an Augar.

SECT. X.

The upper Part of the external convex Surface (Fig. 3. *A.*) has a very ſharp Edge, in which the firſt Series of Fibres begins from one Point; which Fibres gradually dilating, and running lengthwiſe, end about the middle Part of it; and this middle Part makes a right Angle with the upper Part. In this Part the Fibres being elevated, run croſs-wiſe (Fig. 3. *B.*). The lower Part is thicker than the upper, but ſofter and leſs compact. In this Part the Fibres are raiſed up and rough, firſt curve, then ſtrait, and, like the others, run length-wiſe to the lower Edge of this Part, which is ſtrongly faſtened to the Head by various Ligaments (Fig. 3. *C, D.*).

SECT. XI.

The concave or inner Part of theſe *Hemicrania*, (SECT. IX.) which contains the ſofter Parts of the Head, is very ſmooth; but almoſt in the Middle has a very ſmall and tender Eminence or Proceſs, (in Shape much like Dr. *Rau's* Proceſs in the Organ of Hearing) fixed at one End, and looſe at the other, running almoſt the

the whole Width, and doubtleſs deſtin'd for ſupporting ſome of the inward Parts of the Head (*See* Fig. 4 *A*.).

Sect. XII.

Theſe two *Hemicrania*, connected together by ſtrong Ligaments, and as it were by a ſmall Hinge, (by means whereof they can dilate without ſeparateing) beſides their defending the ſoft Head from external Injuries, are the Inſtruments wherewith the Animal gets its Food. For whatever way it turns its Head, the raiſed and rough Fibres, running either length-wiſe or croſs-wiſe, always rub off ſome of the Wood.

Sect. XIII.

Theſe *Hemicrania* carefully removed, the contained Parts (Fig. 6) are laid open to View; but they are ſo ſoft, and of ſo wonderful a Structure, that the Eye, though armed with a Microſcope, can neither diſcern their true Make or Uſe. Firſt, indeed, there appears a Membrane enveloping the whole Head; in the middle and anterior Part, which is not covered by the ſaid *Hemicrania*, it appears as if raiſed by a *Tubercle*, (Fig. 6. *c*.) and in that Place it is of a red Colour; but the lower ligamentous Edge firmly adheres both to the ſmall Proceſs (Sect. XI.) and to the lower Edge of the *Hemicranium*.

Sect. XIV.

This Membrane carefully ſeparated and removed, (Fig. 7. *A*. *A*.) in the middle of the ſubjacent Pulp you will find a ſmall Pear-like Body, perfectly pellucid, ſomewhat protuberant above the other Parts, which

which made the *Tubercle* in the Membrane (Sect. XII.). It is much harder than the other contained Parts of the Head and Body; ſo that it will bear cutting with the Scalpel. It is of a red Colour, as perfectly pellucid as a Drop of Water; of the Shape of a Pear, from a larger Baſis terminating in a Point. I cannot better reſemble it to any thing than to the Cryſtalline Lens of the Eye: Yet in Spirit of Wine it preſerved its Tranſparency, but its Bulk was diminiſhed (Fig. 7. *B*.).

I cannot gueſs its Uſe: It does not ſeem to me, as it does to ſome, to be the Organ of Sight; for the Worm ſeems to have no Occaſion for an Eye, as ſpending its Life in perfect Darkneſs; beſides that the inveſting Membrane is not tranſparent, and therefore would obſtruct the Sight.

Sect. XV.

At the Sides, where the lower Edges of the *Hemicrania* do not touch one another, there is a ſort of Cavity; and in theſe Sides the harder Fibres may be diſtinguiſhed, diſpoſed in ſuch a manner, as perfectly to reſemble the Gills of Fiſh; and through them the Worm ſeems to breathe.

Sect. XVI.

The extreme Softneſs of the other Parts of the Head prevents our coming at the Knowledge of the Uſe of the Membranes furniſhed with *Fibres* of different Tendencies, or inquiring by what Organs the Worm takes the Wood ſhaved off by the *Hemicrania*, or rough Shells; whether it does this by Suction, or not; by what Muſcles, or how acting, this wonderful Head is moved. 'Tis probable, indeed, that its Motion conſiſts in the opening and cloſing theſe Shells (SECT VIII.) that ſhave off the Wood; and that the inner Parts have a Power to move on all Sides, as the Ball does in the Socket of the Eye; and perhaps to come forth of theſe Shells, and re-enter after taking their Food. But of theſe things there can be no Certainty, becauſe the Parts diſſolve between the Fingers.

SECT. XVII.

The Body, viewed forward, (Fig. 2.) is of a reddiſh Colour. In the middle appears a Line, often dark-brown, often blackiſh, ſometimes not viſible, ſometimes running near half the Length. The reſt of the Animal is of a whitiſh or grey Colour.

1. If you intend to diſſect it, and examine the Inſide, you muſt firſt remove a thin Membrane ſurrounding the whole Body, which for that Reaſon may be called the *Cutis* or *Cuticula*. When this is removed, there appears an oblong Veſſel placed in the Middle, (Fig. 2.) of a reddiſh Colour, from the ſhaved Wood, of which it is full: Hence it ſeems to be the Stomach, or at leaſt the firſt Organ of Digeſtion.

2. In the lower Part you will find another Veſſel, appearing like a dark-brown Line, which contains the Excrements, of which it is often found full, and diſcharges them at the End of the Tail.

3. At the Sides of the reddiſh Veſſel or Stomach (SECT. XVII. 1.) is placed a white, clammy, fat Subſtance, ſticking to the Fingers, and perhaps conſtituting the Fleſh of the Animal.

SECT. XVIII.

Where the Body ends, the Tail begins, thicker than the Body, and rendered ſtronger by circular *Fibres.* At its End it has two ſmall hard Bodies, containing and defending the tender Extremities of the Tail.

This Tail thicker than the Body terminates in two Ends, the thickeſt of which certainly ſerves for the Diſcharge of the Excrements, the ſlendereſt doubtleſs for Generation: And this it can ſtretch out to an incredible Length, ſo that in Worms that ſeemed to be in Copulation, it appeared above an Inch out of the Pile.

The two ſmall Bodies, that contain theſe Ends of the Tail, are of a harder Subſtance than even the *Hemicrania.* The outer Part is gibbous, the inner hollowed. The lower End is bifid; whence I conjecture, that they ſerve the Animal for Feet, when it is mounting upright, or corroding the Wood; by leaning on them as on a Prop (Fig. 8.).

SECT. XIX.

The above-deſcribed Worm dwells now very ſecurely in a teſtaceous Tube of a white Colour, which it exactly fills, yet ſo as to be able to move with Freedom. That Tube, like the Coverings of Snails, *&c.* daily grows with the Animal, from the Matter which perſpires from its Body; whence it is ſometimes found ſtrait, ſometimes bent, according to the Courſe which the Worm ſteered in corroding.

SECT. XX.

As to their Generation, it is probable enough, that, analogous to that of other Inſects, it is performed by Copulation of Male and Female: For they can ſo lengthen one End of their Tail, and thruſt it out of the Pile, that they may copulate by that means. Then they lay their Eggs in the Water cloſe to the Piles, to which they ſtick by their clammy viſcid Matter, (ſuch, for Example, as Frog's Spawn) and afterwards, by the Heat of the Sun, hatch the Worm, which immediately endeavours to get into the Pile (See SECT. II. and III.).

I could not obſerve the Difference of Sex, either with my Eye, or a Microſcope. Some think them Hermaphrodites, as Snails, and that they copulate in the ſame Manner: But theſe Conjectures are not very probable.

SECT. XXI.

Many Remedies and Secrets for deſtroying theſe dangerous Enemies were immediately boaſted of, which for the moſt part were Preparations of *Arſenic* or *Mercury*, and are not worth enumerating: I will only give the Receipt of one, which is the beſt and ſureſt of all.

Take an Iron Plate of an oblong Figure, and of the Width of the Pile, with a ſtrong Handle at each End. One End of this Plate muſt be armed with thick Nails half an Inch long, and about an Inch aſunder. The Nails of this Plate muſt be driven into a Pile of any ſlight Wood, with a Hammer, and then the Plate pulled off by means of its Handles.

And this is to be ſo often repeated until the Pile is perforated every-where with ſmall Holes: Then it muſt be dawbed over with *Varniſh* in the hotteſt Sun (the *Varniſh* is imbibed by the ſoft Wood with ſo many Holes in it); and while the *Varniſh* is yet hot, let it be ſtrewed over with *Brick-duſt:* And this is to be repeated three or four times, after the preceding *Varniſh* is thorough dry, till the Pile is intirely ſurrounded with a ſtony Cruſt, which will be impenetrable to all Inſects, and laſt many Years.

But the Divine Clemency has already ſo far deſtroyed theſe pernicious Inſects, which multiplied ſo prodigiouſly for eight or nine Years paſt, that there is great room for Hope, that our Country will in a ſhort time be intirely freed from them.

An Explanation of TAB. II.

Fig. 1. The Pile-worm of its natural Size, lying on its Belly.
Fig. 2. The ſame lying on its Back.

See SECTION XVII.

A. The Stomach.
B. The Duct full of Excrements.
C. The Tail, with its Defences *dd*, and its Point *e*, which it can ſtretch out.

The Six following Figures are repreſented much larger than Life.

SECT. X.

Fig. 3. *AA*. The firſt Series of Fibres running ſtrait down.

BB. The ſecond Series running tranſverſely.

CC. The third taking a different Courſe.

DD. The lower Edge, which is infixed to the Head.

SECT. XI.

Fig. 4. The Shell or *Hemicranium* ſeen on the Inſide with the Proceſs running croſs it, one End of which *A* is fix'd, the other *a* is moveable.

SECT. XII.

Fig. 5. *A.B.C.D.* The ſame as in Fig. 3.

E. The Hinge, whereby theſe are connected, and may eaſily dilate or open.

SECT. XIII.

Fig. 6. *AA.* The Membrane covering the Head freed from the *Hemicrania,* which were attach'd to this Membrane.

B. The Place, where the *Hemicrania* were connected.

c. The middle anterior Part, in which the *Tubercle* was prominent.

SECT. XIV.

Fig. 7. *AA.* The Membrane of Fig. 6. ſeparated and turned back.

B. The pellucid pyriform Body lying in the middle of the Head, and which formed

c. The *Tubercle.*

SECT. XVIII.

Fig. 8. The two Defences of the Tail, of which the exterior Part *A.* is gibbous, the other or interior *B.* is, as it were, hollowed; Theſe Extremities are bifid. *C.* By this Part they are joined to the Tail.

VI. *Two Obſervations of* Exploſions *in the* Air; *one heard at* Halſted *in* Eſſex, *by the Rev. Mr.* A. Vievar, *Miniſter of that Place; the other by* Sam. Shepheard, *Eſq;* of Springfield *in the ſame County.*

ON *Sunday* the 12th of *March* 1731-2. between One and Two o'Clock in the Afternoon, walking in my Garden by the Side of a Canal, I heard as it had been a large Clap of Thunder from the North-Eaſt, being a very clear Day, and no Clouds appearing. While I was looking into the Air, the Noiſe was repeated very loud, but ſeemed more like the violent Fall of a Houſe, inſomuch that I expected every Moment an Out-cry from the Town: But I was ſoon undeceived, when it began again, and I found it made towards me, with a different Noiſe from what I had heard, that is, like the Grinding of Flint-ſtones, but very loud: The Dimenſions of it ſeem'd to be about three Foot wide. I found it ſink in the Air, and as it ſeem'd to point directly at my Head, I laid myſelf down upon a Graſs-ſlope, to let it paſs over me. However, at the upper End of

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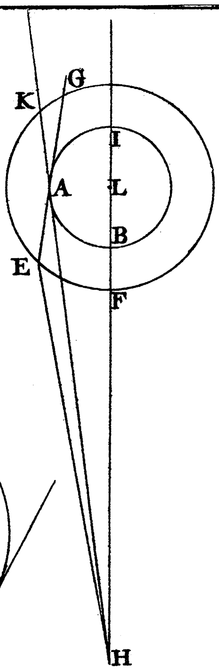
TAB. I.

Fig. 1.



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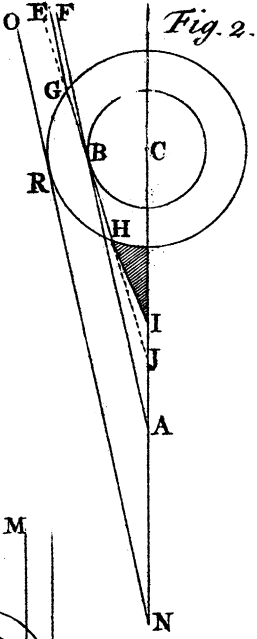
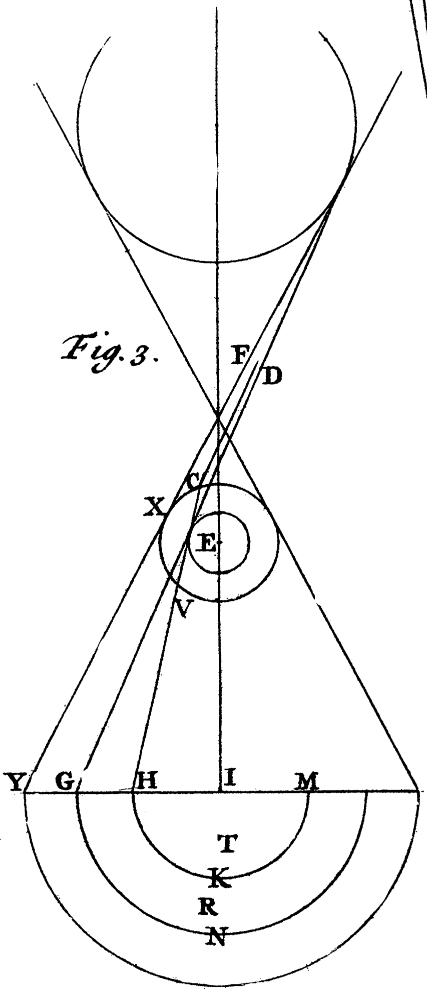


Fig. 3.



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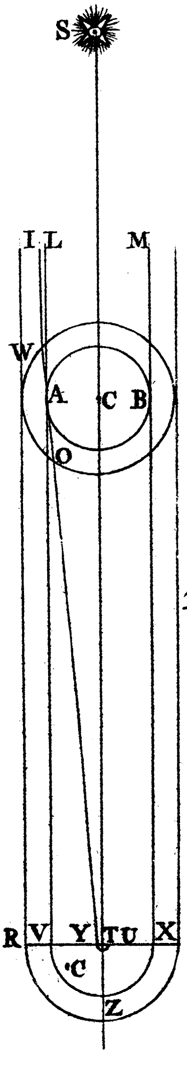
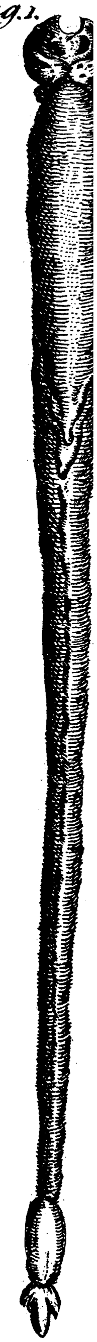


J. Mynde Sculp.

Fig. 1.

TAB. II.



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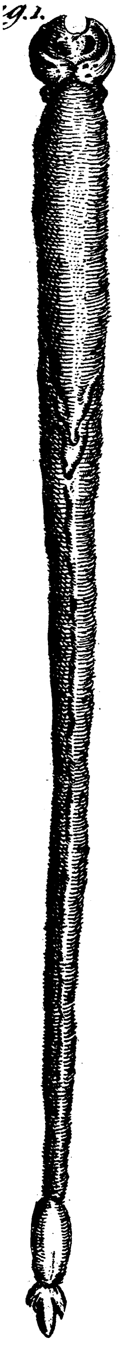

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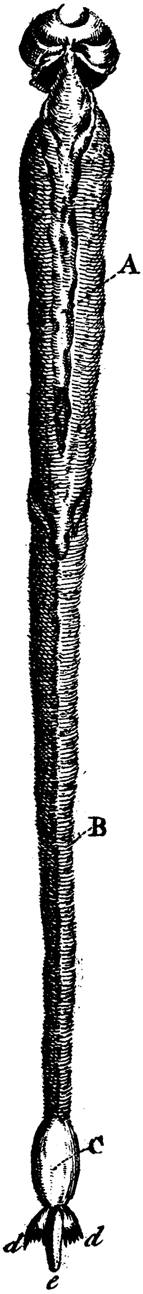

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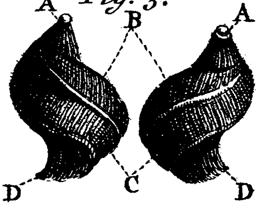

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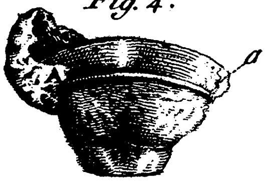

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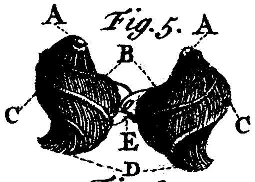


Fig. 6.

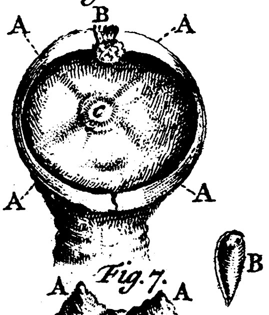
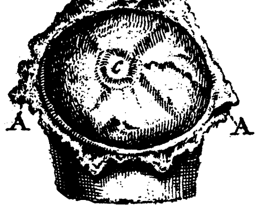


Fig. 7.



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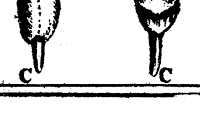

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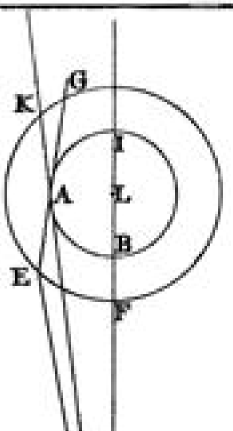
TAB. I.

Fig. 1.



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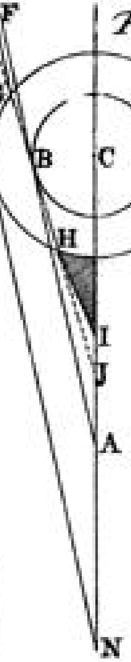

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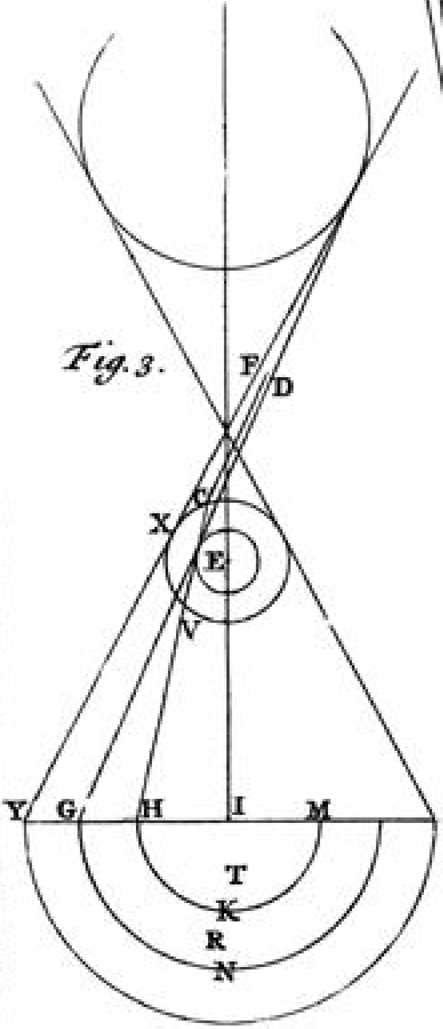
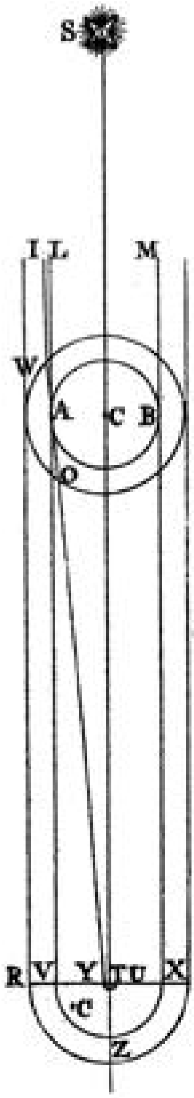


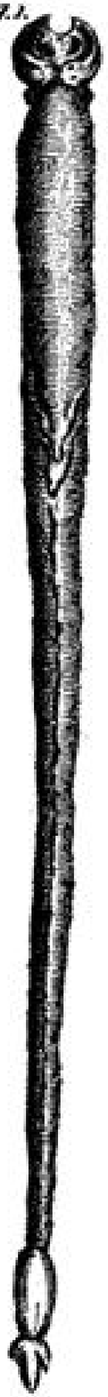
Fig. 4.



J. Mynde Sculp.

TAB. II.

Fig. 1.



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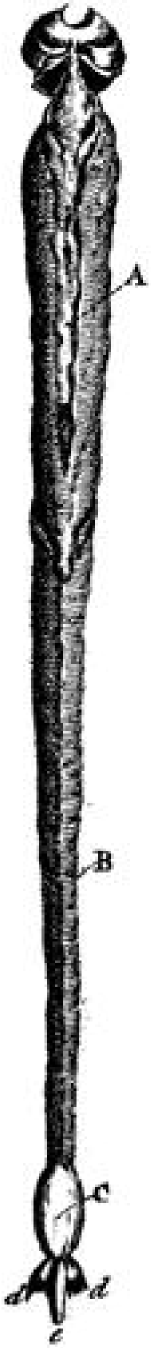

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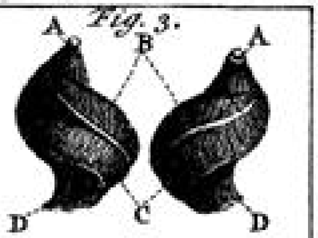

Fig. 4.

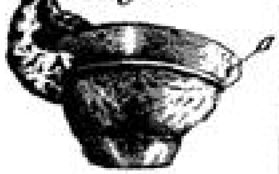

Fig. 5.

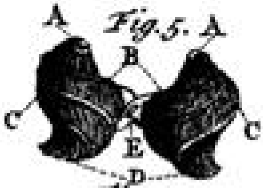

Fig. 6.

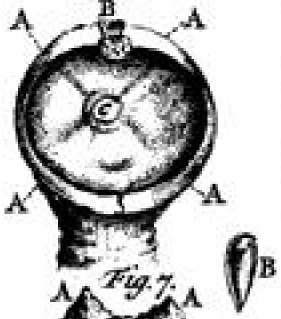

Fig. 7.

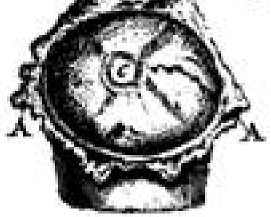

Fig. 8.